Algebraic Operads

An Algorithmic Companion

Murray R. Bremner
Vladimir Dotsenko

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Algebraic Operads An Algorithmic Companion

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Algebraic Operads An Algorithmic Companion:

Algebraic Operads Murray R. Bremner,Vladimir Dotsenko,2016-04-06 This book presents a systematic treatment of Grobner bases in several contexts The book builds up to the theory of Grobner bases for operads due to the second author and Khoroshkin as well as various applications of the corresponding diamond lemmas in algebra Throughout the book both the mathematical theory and computational methods are emphasized and numerous algorithms examples and exercises are provided to clarify and illustrate the concrete meaning of abstract theory **Algebraic Operads** Murray R. Bremner,Vladimir Dotsenko,2016-04-06 This book presents a systematic treatment of Grobner bases in several contexts The book builds up to the theory of Grobner bases for operads due to the second author and Khoroshkin as well as various applications of the corresponding diamond lemmas in algebra Throughout the book both the mathematical theory and computational methods are emphasized and numerous algorithms examples and exercises are provided to clarify and illustrate the concrete meaning of abstract theory *Nonsymmetric Operads in Combinatorics* Samuele Giraudo,2019-01-04 Operads are algebraic devices offering a formalization of the concept of operations with several inputs and one output Such operations can be naturally composed to form more complex ones Coming historically from algebraic topology operads intervene now as important objects in computer science and in combinatorics A lot of operads involving combinatorial objects highlight some of their properties and allow to discover new ones This book portrays the main elements of this theory under a combinatorial point of view and exposes the links it maintains with computer science and combinatorics Examples of operads appearing in combinatorics are studied The modern treatment of operads consisting in considering the space of formal power series associated with an operad is developed Enrichments of nonsymmetric operads as colored cyclic and symmetric operads are reviewed **Nonassociative Mathematics and its Applications** Petr Vojtěchovský,Murray R. Bremner,J. Scott Carter,Anthony B. Evans,John Huerta,Michael K. Kinyon,G. Eric Moorhouse,Jonathan D. H. Smith,2019-01-14 Nonassociative mathematics is a broad research area that studies mathematical structures violating the associative law x yz xy z The topics covered by nonassociative mathematics include quasigroups loops Latin squares Lie algebras Jordan algebras octonions racks quandles and their applications This volume contains the proceedings of the Fourth Mile High Conference on Nonassociative Mathematics held from July 29 August 5 2017 at the University of Denver Denver Colorado Included are research papers covering active areas of investigation survey papers covering Leibniz algebras self distributive structures and rack homology and a sampling of applications ranging from Yang Mills theory to the Yang Baxter equation and Laver tables An important aspect of nonassociative mathematics is the wide range of methods employed from purely algebraic to geometric topological and computational including automated deduction all of which play an important role in this book *Two Algebraic Byways from Differential Equations: Gröbner Bases and Quivers* Kenji Iohara,Philippe Malbos,Masa-Hiko Saito,Nobuki Takayama,2020-02-20 This edited volume presents a fascinating collection of lecture notes

focusing on differential equations from two viewpoints formal calculus through the theory of Gr bner bases and geometry via quiver theory Gr bner bases serve as effective models for computation in algebras of various types Although the theory of Gr bner bases was developed in the second half of the 20th century many works on computational methods in algebra were published well before the introduction of the modern algebraic language Since then new algorithms have been developed and the theory itself has greatly expanded In comparison diagrammatic methods in representation theory are relatively new with the quiver varieties only being introduced with big impact in the 1990s Divided into two parts the book first discusses the theory of Gr bner bases in their commutative and noncommutative contexts with a focus on algorithmic aspects and applications of Gr bner bases to analysis on systems of partial differential equations effective analysis on rings of differential operators and homological algebra It then introduces representations of quivers quiver varieties and their applications to the moduli spaces of meromorphic connections on the complex projective line While no particular reader background is assumed the book is intended for graduate students in mathematics engineering and related fields as well as researchers and scholars

Maple in Mathematics Education and Research Jürgen Gerhard,Ilias Kotsireas,2020-02-27 This book constitutes the refereed proceedings of the third Maple Conference MC 2019 held in Waterloo Ontario Canada in October 2019 The 21 revised full papers and 9 short papers were carefully reviewed and selected out of 37 submissions one invited paper is also presented in the volume The papers included in this book cover topics in education algorithms and applciations of the mathematical software Maple **Leavitt Path Algebras and Classical K-Theory** A. A. Ambily,Roozbeh Hazrat,B. Sury,2020-01-17 The book offers a comprehensive introduction to Leavitt path algebras LPAs and graph C algebras Highlighting their significant connection with classical K theory which plays an important role in mathematics and its related emerging fields this book allows readers from diverse mathematical backgrounds to understand and appreciate these structures The articles on LPAs are mostly of an expository nature and the ones dealing with K theory provide new proofs and are accessible to interested students and beginners of the field It is a useful resource for graduate students and researchers working in this field and related areas such as C algebras and symbolic dynamics **Bimonoids for Hyperplane Arrangements** Marcelo Aguiar,Swapneel Mahajan,2020-03-19 The goal of this monograph is to develop Hopf theory in a new setting which features centrally a real hyperplane arrangement The new theory is parallel to the classical theory of connected Hopf algebras and relates to it when specialized to the braid arrangement Joyal s theory of combinatorial species ideas from Tits theory of buildings and Rota s work on incidence algebras inspire and find a common expression in this theory The authors introduce notions of monoid comonoid bimonoid and Lie monoid relative to a fixed hyperplane arrangement They also construct universal bimonoids by using generalizations of the classical notions of shuffle and quasishuffle and establish the Borel Hopf Poincar Birkhoff Witt and Cartier Milnor Moore theorems in this setting This monograph opens a vast new area of research It will be of interest to students and researchers working in the areas of

hyperplane arrangements semigroup theory Hopf algebras algebraic Lie theory operads and category theory *Coxeter Bialgebras* Marcelo Aguiar,Swapneel Mahajan,2022-11-17 The goal of this monograph is to develop Hopf theory in the setting of a real reflection arrangement The central notion is that of a Coxeter bialgebra which generalizes the classical notion of a connected graded Hopf algebra The authors also introduce the more structured notion of a Coxeter bimonoid and connect the two notions via a family of functors called Fock functors These generalize similar functors connecting Hopf monoids in the category of Joyal species and connected graded Hopf algebras This monograph opens a new chapter in Coxeter theory as well as in Hopf theory connecting the two It also relates fruitfully to many other areas of mathematics such as discrete geometry semigroup theory associative algebras algebraic Lie theory operads and category theory It is carefully written with effective use of tables diagrams pictures and summaries It will be of interest to students and researchers alike

CMUC ,2016 **Algorithms In Algebraic Geometry And Applications** Laureano Gonzalez-Vega,1996-06 This volume arises from the contributions presented at the MEGA 94 Con ference Metodos Efectivos en Geomctria Algebraica Effective Methods in Algebraic Geometry held at the University of Cantabria Santander Spain April 59 1994 Previous sessions of this biannual conference had taken place in Castiglioncello Livorno Italy 1990 and in Nice France 1992 and the cor responding proceedings have been published in the Birkhauser series Progress in Mathematics volumes no 94 and 109 respectively The present collection consists of twenty articles involvillg miscellaneous topics concerning algorithms in algebra algebraic geometry and related appli cations Fourteen of these papers correspond to the contents of the Conference s regular scientific program and have been selected by the MEGA Committee from the submitted contributions after a very rigorous refereeing procedure entailing an average of three independent reports per paper and two Program Committee panel discussions before and after the Conference The remaining six papers by S Beck M Kreuzer M Bronstein E V Flvnn 1 Itenberg J P Merlet and 1 1 Seppala correspond to invited talks and have also been subject to a post conference refereeing procedure **Algorithmic Algebra** Bhubaneswar Mishra,2012-12-06 Algorithmic Algebra studies some of the main algorithmic tools of computer algebra covering such topics as Gr bner bases characteristic sets resultants and semialgebraic sets The main purpose of the book is to acquaint advanced undergraduate and graduate students in computer science engineering and mathematics with the algorithmic ideas in computer algebra so that they could do research in computational algebra or understand the algorithms underlying many popular symbolic computational systems Mathematica Maple or Axiom for instance Also researchers in robotics solid modeling computational geometry and automated theorem proving community may find it useful as symbolic algebraic techniques have begun to play an important role in these areas The book while being self contained is written at an advanced level and deals with the subject at an appropriate depth The book is accessible to computer science students with no previous algebraic training Some mathematical readers on the other hand may find it interesting to see how algorithmic constructions have been used to provide fresh proofs for some classical theorems The book also contains a large

number of exercises with solutions to selected exercises thus making it ideal as a textbook or for self study Mathematical Reviews ,2004 *Algorithms in Real Algebraic Geometry* Saugata Basu,Richard Pollack,Marie-Françoise Coste-Roy,2007-04-21 The algorithmic problems of real algebraic geometry such as real root counting deciding the existence of solutions of systems of polynomial equations and inequalities finding global maxima or deciding whether two points belong in the same connected component of a semi algebraic set appear frequently in many areas of science and engineering In this textbook the main ideas and techniques presented form a coherent and rich body of knowledge Mathematicians will find relevant information about the algorithmic aspects Researchers in computer science and engineering will find the required mathematical background Being self contained the book is accessible to graduate students and even for invaluable parts of it to undergraduate students This second edition contains several recent results on discriminants of symmetric matrices real root isolation global optimization quantitative results on semi algebraic sets and the first single exponential algorithm computing their first Betti number *Some Tapas of Computer Algebra* Arjeh M. Cohen,Hans Cuypers,Hans Sterk,1998-12-15 This book presents the basic concepts and algorithms of computer algebra using practical examples that illustrate their actual use in symbolic computation A wide range of topics are presented including Groebner bases real algebraic geometry lie algebras factorization of polynomials integer programming permutation groups differential equations coding theory automatic theorem proving and polyhedral geometry This book is a must read for anyone working in the area of computer algebra symbolic computation and computer science **Algorithms for Computer Algebra** Keith O. Geddes,Stephen R. Czapor,George Labahn,1992-09-30 Algorithms for Computer Algebra is the first comprehensive textbook to be published on the topic of computational symbolic mathematics The book first develops the foundational material from modern algebra that is required for subsequent topics It then presents a thorough development of modern computational algorithms for such problems as multivariate polynomial arithmetic and greatest common divisor calculations factorization of multivariate polynomials symbolic solution of linear and polynomial systems of equations and analytic integration of elementary functions Numerous examples are integrated into the text as an aid to understanding the mathematical development The algorithms developed for each topic are presented in a Pascal like computer language An extensive set of exercises is presented at the end of each chapter Algorithms for Computer Algebra is suitable for use as a textbook for a course on algebraic algorithms at the third year fourth year or graduate level Although the mathematical development uses concepts from modern algebra the book is self contained in the sense that a one term undergraduate course introducing students to rings and fields is the only prerequisite assumed The book also serves well as a supplementary textbook for a traditional modern algebra course by presenting concrete applications to motivate the understanding of the theory of rings and fields *Algorithmic and Experimental Methods in Algebra, Geometry, and Number Theory* Gebhard Böckle,Wolfram Decker,Gunter Malle,2018-03-22 This book presents state of the art research and survey articles that highlight work done

within the Priority Program SPP 1489 Algorithmic and Experimental Methods in Algebra Geometry and Number Theory which was established and generously supported by the German Research Foundation DFG from 2010 to 2016 The goal of the program was to substantially advance algorithmic and experimental methods in the aforementioned disciplines to combine the different methods where necessary and to apply them to central questions in theory and practice Of particular concern was the further development of freely available open source computer algebra systems and their interaction in order to create powerful new computational tools that transcend the boundaries of the individual disciplines involved The book covers a broad range of topics addressing the design and theoretical foundations implementation and the successful application of algebraic algorithms in order to solve mathematical research problems It offers a valuable resource for all researchers from graduate students through established experts who are interested in the computational aspects of algebra geometry and or number theory *Algorithms in Algebraic Geometry* Alicia Dickenstein,Frank-Olaf Schreyer,Andrew J. Sommese,2010-07-10 In the last decade there has been a burgeoning of activity in the design and implementation of algorithms for algebraic geometric computation The workshop on Algorithms in Algebraic Geometry that was held in the framework of the IMA Annual Program Year in Applications of Algebraic Geometry by the Institute for Mathematics and Its Applications on September 2006 is one tangible indication of the interest This volume of articles captures some of the spirit of the IMA workshop **Computational Methods in Commutative Algebra and Algebraic Geometry** Wolmer Vasconcelos,2004-05-18 This ACM volume deals with tackling problems that can be represented by data structures which are essentially matrices with polynomial entries mediated by the disciplines of commutative algebra and algebraic geometry The discoveries stem from an interdisciplinary branch of research which has been growing steadily over the past decade The author covers a wide range from showing how to obtain deep heuristics in a computation of a ring a module or a morphism to developing means of solving nonlinear systems of equations highlighting the use of advanced techniques to bring down the cost of computation Although intended for advanced students and researchers with interests both in algebra and computation many parts may be read by anyone with a basic abstract algebra course Algorithmic Algebra and Number Theory B.Heinrich Matzat,Gert-Martin Greuel,1999 This book contains 22 lectures presented at the final conference of the German research program Algorithmic Number Theory and Algebra 1991 1997 sponsored by the Deutsche Forschungsgemeinschaft The purpose of this research program and the meeting was to bring together developers of computer algebra software and researchers using computational methods to gain insight into experimental problems and theoretical questions in algebra and number theory The book gives an overview on algorithmic methods and results obtained during this period mainly in algebraic number theory commutative algebra and algebraic geometry and group and representation theory Some of the articles illustrate the current state of the computer algebra systems developed with support from the research program for example KANT and LiDIA for algebraic number theory SINGULAR REDLOG and

INVAR for commutative algebra and invariant theory respectively and GAP SYSYPHOS and CHEVIE for group and representation theory

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